

Design and development of a pictorial game-based Chinese character module for non-native primary school learners

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ABSTRACT

This study aims to develop a pictorial game-based Chinese character module (CCM) for non-native Chinese language learners in Malaysian National-Type Chinese Primary Schools (SJ KCs) to strengthen their recognition and motivation. The design and development research (DDR) model is applied in three phases: needs analysis, design and development, and evaluation. During the needs analysis phase, 75 first-year Chinese language teachers will complete a survey, and five teachers will participate in interviews to identify students' learning challenges and instructional needs. In the second phase, a prototype of the CCM will be developed and refined based on feedback from 15 experts using the fuzzy delphi method (FDM). In the third phase, a quasi-experimental study involving 200 first-year non-native students (100 in the control group and 100 in the treatment group) will be conducted to evaluate the intervention's effectiveness using pre- and post-tests, as well as teacher and student questionnaires. The CCM is expected to improve Chinese character recognition skills and increase motivation through pictorial and game-based strategies. If proven effective, the CCM could be scaled for broader classroom use and integrated into the national curriculum as a supplementary tool to create a more inclusive and equitable learning environment in SJ KCs.

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1. INTRODUCTION

Due to China's growing influence on the regional and international stage, Mandarin has become one of the most widely spoken languages globally. It is the second most spoken language in the world, with over 1.1 billion speakers [1], [2]. Among them, 82.1% are native speakers, while 17.9% are non-native speakers. Recognizing its global importance, the United Nations World Tourism Organization (UNWTO) added Mandarin as one of its official languages in 2021.

Malaysia is a multicultural country with different languages and cultures, and Mandarin plays a special role in the education system. National-Type Chinese Primary Schools (SJ KCs), which use Mandarin as the main medium of instruction, were established for Chinese students but now enroll a growing number of non-Chinese students [3]. The percentage of non-native pupils in SJ KCs has increased from 3.05% in 1989 to 19.75% in 2020, reflecting the growing interest among non-Chinese families in Mandarin education.

However, studies show that more than 80% of teachers feel non-native learners in SJKCs do not perform well in terms of learning outcomes, methods, attitudes, and classroom participation [4].

The Chinese writing system itself is one of the biggest challenges for non-native learners. Unlike alphabet-based languages such as English or Malay, each Chinese character carries meaning through its shape and structure. Reading proficiency in Mandarin therefore depends heavily on character recognition, making it a major hurdle for non-native learners [5], [6]. Many characters originated from pictorial representations of real objects [7]; for example, the character “日” (rì, “sun”) was derived from an early drawing of the sun. Over time, these early pictures gradually developed into the Chinese characters we use today. Studies have shown that using pictorial elements in teaching helps learners recognize characters more easily and makes the learning process more enjoyable [8], [9].

Besides using pictures, game-based learning can boost students’ engagement and strengthen their ability to recognize characters through repetition, challenges, and rewards. Many studies have shown that when interactive elements such as word games, flashcards, and simple multimedia tools are added to the lessons, learners become more active in recognizing Chinese characters [10], [11]. Research on various game-based Chinese character learning tools demonstrates significant improvements in character recognition, learning motivations, and engagement [12], [13], including the use of board games and digital apps [11], [14]. Using pictures together with game-based activities offers a promising way to meet the learning needs of non-native pupils in SJKCs.

Yet, even with the rising demand for Mandarin and the proven benefits of these approaches, there is a lack of structured resources and teaching methods tailored for non-native learners in Malaysian primary schools [15], [16]. Most past studies have focused on adult or university learners [17]–[21], tested modules on native speakers [10], limited their context to other countries like Singapore [11], or took a general approach and did not focus on Chinese character structure [22]–[24]. Filling this gap is critical to help non-native learners recognize Chinese characters through effective, age-appropriate methods.

Building on these insights, this study investigates the concept of developing a Chinese Character Module (CCM) that combines pictorial and game-based learning strategies to address these gaps. The objectives of this study are to: i) identify the need for a CCM; ii) design and develop it based on the data from needs analysis and expert feedback; and iii) propose a future evaluation of its effectiveness and suitability through pre-test and post-test and teacher feedback. The study seeks to develop a CCM that would facilitate and motivate non-native learners of Mandarin. Figure 1 presents the conceptual framework of this study.

Table 1. Synthesis of previous studies on language learning modules and their gaps

Author(s)	Focus	Findings	Gap/limitation
Liu <i>et al.</i> [17]	Reading strategies	Advanced learners perform better	Not suitable for beginners
Cao <i>et al.</i> [18]	Motion graphics for stroke order	Improved learning effectiveness	Tested on university students
Low [19]	Mandarin e-module	Supports workplace communication	Adult learners only
Lee and Yusof [14]	Board game for characters	Improved confidence and recognition	Tested on adult learners
Tan and Dalim [22]	Vocabulary app	Supports basic vocabulary learning	Not focused on character structure
Kang and Kang [20]	Multimedia platform for character learning	Improved accuracy and processing speed	Not designed for young primary learners
Lin <i>et al.</i> [11]	Game app for primary students	Improved interest and memory	Context limited to Singapore
Yang and Cao [21]	Teaching strategies in CFL	Suggest use of culture and new media	Focus on adult/university learners
Yulu and Masran [23]	Multimedia learning	Improved collaboration and learning	General approach, not specific module
Wang [13]	Digital game for radicals	Improved recognition and engagement	Tested on university students
Zahari <i>et al.</i> [24]	Needs analysis (ESL writing)	Shows need for fun learning modules	Not related to Chinese characters
Gui <i>et al.</i> [15]	Multimodal module	Enhanced reading and engagement	Focus on university learners
Wu <i>et al.</i> [10]	Multimedia learning	Improved recognition skills	Conducted with native learners

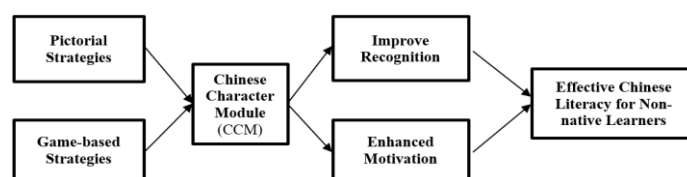


Figure 1. Conceptual framework of pictorial game-based CCM

2. METHOD

Methodology refers to a structured and theoretical approach that researchers apply within a field of study, serving as the framework or backbone of research to generate findings [25], [26]. The processes of design and evaluation provide an empirical foundation for developing instructional and non-instructional products, tools, and both new and improved development models [27]. This study applied the design and development research (DDR) model, a structured, evidence-based approach to educational product development. According to Richey and Klein [28], DDR includes two types: research of a product/tool and research of a model. Table 2 presents the categories of these two DDR types. This study uses type one to develop the CCM. The DDR model offers a systematic and evidence-based framework that not only clarifies the design and development process but also ensures the validity and reliability of data collection. This research design consists of three phases that include a needs analysis phase, a design and development phase, and an evaluation phase.

Table 2. Categories of DDR

Aspect	Type one (research of product and tool)	Type two (research of a model)
Emphasis	Evaluate the design, development, or evaluation of a specific product or project	The study of the design, development, or evaluation process, tools, or models
Outcomes	Based on those products, they had been developed and the analysis of conditions that support their use	Creating new design and development methods or models and identifying the conditions that support their effective use
Conclusion	Context-specific conclusion	Generalized conclusion

2.1. First phase: needs analysis

The first phase of this study focuses on analyzing the needs of the aspect in the development of the CCM. In this study, the researcher will analyze several documents, such as the Standards-based Curriculum and Assessment Document (DSKP) and Chinese language textbooks in Malaysia and abroad, to ascertain the content required in the development of the module. Next, a survey will be conducted with Year One Chinese language teachers using a questionnaire instrument on the content, pedagogy, and technology requirements. In addition, structured interviews will be conducted with selected Year One Chinese teachers to gain deeper insights into their views on the same three aspects. To enhance the validity of the findings, data source triangulation will be employed. The needs analysis survey will involve 75 teachers, selected through simple random sampling from the total population of 89 first-year Chinese language teachers teaching in SJKCs in the Hulu Langat district. Participation will be voluntary to answer the questionnaire. Subsequently, five teachers will be selected through simple random sampling to participate in structured interviews, allowing the researcher to explore their perspectives in greater depth.

2.2. Second phase: design and development

In the second phase, the prototype of CCM will be designed and developed. Once completed, the CCM prototype will be sent to selected experts who meet the specific criteria. At the same time, a consent form and a checklist for the main constructs and items of the CCM will be sent to experts to obtain their feedback. The fuzzy Delphi method (FDM) will be applied during this phase as it provides an effective way to address both clear and uncertain aspects of the issues under study. The experts will score each item with a seven-point Likert scale. After that, the scores will be changed into fuzzy values using triangular numbers [29]. A triangular number has three points: the smallest value (m_1), the value that best represents the expert's view (m_2), and the largest value (m_3). Table 3 shows how each Likert score matches its fuzzy value.

Table 3. Comparison of fuzzy scale values and Likert scale values

Level of agreement	Fuzzy scale		Likert scale	
Strongly agree	0.9	1	1	7
Totally agree	0.7	0.9	1	6
Agree	0.5	0.7	0.9	5
Moderately agree	0.3	0.5	0.7	4
Disagree	0.1	0.3	0.5	3
Totally disagree	0	0.1	0.3	2
Strongly disagree	0	0	0.1	1

Next, the threshold value (d) will be calculated to determine the percentage of expert agreement for each item. Items with a threshold of $d \leq 0.2$ will be accepted; those exceeding this value will be re-examined

[30], [31]. In addition, any item will be adopted if the percentage of agreement among experts is $\geq 75\%$ [32]. The formula of threshold value (d):

$$d(\tilde{m}, \tilde{n}) = \sqrt{\frac{1}{3} [(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2]}$$

Based on this formula, the values of m_1 , m_2 , and m_3 represent the fuzzy average values, while the values of n_1 , n_2 , and n_3 are the fuzzy values for each survey item. The formula for calculating fuzzy scores (A_{max}) is:

$$A_{max} = \frac{1}{3} (m_1 + m_2 + m_3)$$

Once agreement levels are established, the defuzzification process will be applied to calculate the average fuzzy scores (A_{max}), which indicate item priority. The α -cut value is set at 0.5: items scoring below 0.5 will be rejected, while those above 0.5 will be accepted [33], [34]. Based on these results, the CCM will be revised before moving to the next phase.

There are various perspectives regarding the appropriate number of experts required for the FDM. Some suggest a range of 10 to 50 experts [35], while others recommend between 10 to 15 experts [36]. Based on these views, this study will involve 15 experts. This number is enough to reach a reliable agreement, minimize the influence of any single expert, and keep the process practical and manageable. All experts will be chosen through purposive sampling and must meet several criteria. They should have at least 10 years of experience and a stable career in the same field [37], and they must have the knowledge and skills related to the focus of the study [38]. These criteria ensure that the selected experts are both highly knowledgeable and directly aligned with the objectives of the research.

2.3. Third phase: evaluation

During the third phase, the developed module will be evaluated for its effectiveness using a quasi-experimental design, as the sample or respondents cannot be randomly assigned [39]. In the context of this study, the quasi-experimental approach is appropriate because randomly reassigning students within existing classes would disrupt the current classroom structure. The specific quasi-experimental design used in this study is illustrated in Table 4.

Table 4. Design of quasi-experimental study

Group	Respondent	Pre-test	Approach	Post-test
Treatment group	N ₁	U ₁	X	U ₃
Control group	N ₂	U ₂	Y	U ₄

Note: N=inequivalent respondent groups, X=CCM, Y=conventional, and U=measurement

In the quasi-experimental design, two groups of participants will be involved: a control group and a treatment group. Purposive sampling method will be used to select non-native Chinese language learners who meet specific criteria, that is those who do not use Chinese at home as their first language. This study plans to involve 200 students, with 100 in the treatment group and 100 in the control group. Cohen [40] notes that about 64 students per group are generally enough to reach the conventional power level of 0.80 at $\alpha=0.05$ for detecting a medium effect. By planning for 100 students in each group, the design goes beyond this minimum, giving more confidence that real differences can be detected, while also allowing for variations across schools and the possibility of some student dropout.

Before the intervention begins, both groups will take a pre-test to assess their initial ability to recognize Chinese characters. After that, the treatment group will start using the CCM. This module is designed for non-native learners and includes pictures, simple games, and other activities to help them learn. At the same time, the control group will continue with conventional teaching methods by relying primarily on standard textbooks and teacher-directed activities.

At the end of the treatment period, both groups will undergo a post-test like the pre-test. This allows for a comparison to determine how much progress each group has made and whether the CCM has a positive effect on students' character recognition skills. Students in the treatment group will be required to answer a questionnaire to share their feedback and perceptions of the CCM. Teachers involved in delivering the CCM will also evaluate its suitability based on their classroom experience.

2.4. Ethical considerations

Before conducting the study, all the participating teachers need to fill out the informed consent, which clearly explains the study's objectives, procedures, potential risks, and anticipated benefits and emphasizes that participation is entirely voluntary. Teachers and students will be informed of their right to withdraw from the study at any stage without any consequences. Besides that, each participant will be assigned a unique identification code to ensure confidentiality and anonymity. All responses will also be stored securely with restricted access. No personally identifiable information will be disclosed in any reports or publications. This study will be submitted for review and approval to the Education Planning and Research Division (EPRD), Ministry of Education Malaysia, in accordance with the ethical research guidelines of Sultan Idris Education University.

2.5. Instruments

In this study, several instruments will be used to collect data and support each phase of the research process. These instruments will help the researcher gather important information from teachers, students, and experts to design, develop, and test the CCM. Each tool has its own purpose and was chosen to fit the goals of the study. In the first phase, two main instruments will be used to analyze the needs of CCM, such as the teacher needs analysis questionnaire and the structured interview guide for teachers. The questionnaire will collect the teaching experiences, the challenges faced by non-native learners, and the support these learners require in recognizing Chinese characters from Year One teachers. The semi-structured interview guide will be used with a smaller group of teachers to obtain more detailed insights into what the module should include. These instruments will help the researcher understand the actual classroom needs, directly supporting the first research objective: to identify the need to develop the CCM for non-native Chinese language learners in primary schools.

In the second phase, which is the design and development stage, the instrument that will be used is the FDM Checklist. This checklist will be sent to selected experts to collect their feedback on the first version of the CCM. The experts will rate and comment on aspects such as content, design, and how well the module reaches the teaching objectives. Their feedback will guide necessary improvements to the module before testing. This activity will align the second research objective: to design and develop the CCM based on expert feedback.

The third phase, which is the evaluation phase, will involve testing the effectiveness and suitability of the CCM. Three instruments will be used in this phase, such as the pre-test and post-test assessment papers, the teacher evaluation questionnaire, and the student evaluation questionnaire. The pre- and post-tests will measure whether students in the treatment group improve in recognizing Chinese characters compared to the control group. After using the module, teachers will complete a questionnaire to provide their opinions on the practicality and usefulness of the CCM in the classroom. Students will also answer a questionnaire to express how they feel about using the CCM, whether it is fun, easy to use, and helpful for learning. These instruments will fulfill the third research objective: to evaluate the effectiveness and suitability of the CCM.

Each instrument planned for this study will play an important role in achieving the research objectives. From understanding the needs in the classroom to improving and testing the module, these tools will support the research in a systematic and effective way. Table 5 shows the instruments to be used in each phase of the study and linked research objective.

To ensure the quality of the data collected, all questionnaires used in this study will undergo both validity and reliability testing before implementation. Content validity and face validity will be established through expert review, where specialists in Chinese language education and instructional design will evaluate each item for clarity, relevance, and alignment with the research objectives. The item-level content validity index (I-CVI) will be calculated for each item, with a value of 0.78 or higher considered acceptable; items with an I-CVI below 0.78 will be reviewed and either revised or removed based on expert feedback [41], [42]. Reliability will be measured using Cronbach's alpha to determine the internal consistency of the questionnaire items, with a coefficient of 0.70 or higher considered acceptable for research purposes [43], [44].

Table 5. Instruments in each phase and the linked research objective

Phase	Instruments	Linked research objective
One: needs analysis	Teacher needs analysis questionnaire Semi-structured interview guide for teachers	Objective 1: identify the need for the CCM
Two: design and development	FDM checklist	Objective 2: design and development of CCM
Three: evaluation	Pre-test and post-test assessment papers Teacher evaluation questionnaire Student evaluation questionnaire	Objective 3: evaluation effectiveness and suitability of CCM

2.6. Research procedures

The research begins with a needs analysis. First, the researcher will review documents such as past studies, teaching frameworks, and the school curriculum to identify gaps and understand what is needed. After that, a survey will be carried out to gather information from teachers, and this will be supported by interviews to gain deeper insights. Based on these findings, the CCM will be designed and developed. The draft module will then be sent to experts for evaluation using the FDM to check whether the content is valid and relevant. After that, the researcher will conduct a pilot study to test the module's feasibility and refine it further. During the evaluation phase, a pre-test will be given to students to measure their starting level before they use the CCM. After the module implementation, a post-test will measure its effectiveness in achieving the intended learning outcomes. A follow-up survey will be conducted to collect feedback on participant satisfaction and engagement. Finally, the researcher will analyze all the collected data. The results will be used to draw conclusions, refine the module, and provide guidance for future use. Figure 2 shows the full sequence of research procedures, from the needs analysis stage to the final evaluation.

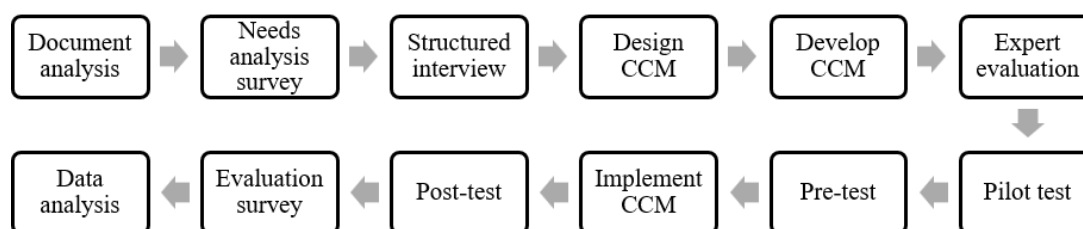


Figure 2. Research procedures

2.7. Data analysis procedures

In this study, different instruments will be used to collect data and analyzed using both quantitative and qualitative methods. Two instruments will be used in the needs analysis phase: the teacher needs analysis questionnaire and the semi-structured interview guide for teachers. Data from the questionnaire will be analyzed using SPSS version 29. Descriptive statistics, including frequency, mean, mode, and median, will be used to help the researcher understand what teachers need and the challenges they face when teaching non-native learners in recognizing Chinese characters. For the semi-structured interviews, the researcher will use thematic analysis. The interview transcripts will be read carefully and coded so that important ideas and repeated patterns can be grouped together, especially those related to content, teaching approaches, and the use of technology.

In the design and development phase, data will be collected through the FDM checklist. The researcher will analyze the data to determine expert feedback on the CCM's contents. The analysis will involve working out the threshold value ($d \leq 0.2$), forming the triangular fuzzy numbers, and then carrying out the defuzzification process. These steps will help the researcher refine the module based on expert comments and suggestions.

In the evaluation phase, three instruments will be used, such as the pre-test and post-test assessment papers, the teacher evaluation questionnaire, and the student evaluation questionnaire. Scores from the pre-test and post-test will be analyzed using descriptive statistics as well as inferential statistics. To find out whether the students in the treatment group improved in recognizing Chinese characters, a paired-sample t-test will be carried out. This test helps show if there is a meaningful difference between their pre-test and post-test results.

To get a clearer picture of each student's progress, a gain score will also be worked out by taking the pre-test mark away from the post-test mark. After that, these gain scores from the treatment group and the control group will be compared using an independent-samples t-test to see which group made more progress. However, using raw gain scores alone may not fully reflect students' progress, especially for those with high initial scores. Because of this, the study will also use the normalized gain (N-gain) method, calculated using the following formula:

$$N\text{-gain} = \frac{(\text{Post-test score} - \text{Pre-test score})}{(\text{Maximum score} - \text{Pre-test score})}$$

This method provides a more reliable measure of individual improvement by accounting for different starting points. The mean N-gain values of both groups will also be compared using an independent samples t-test. This approach ensures a more valid and accurate analysis of the CCM's impact on students' ability to recognize Chinese characters. Finally, data from the teacher and student questionnaires will be

analyzed using descriptive statistics to evaluate the usability and effectiveness of the CCM. Table 6 shows the instruments, type of data and analysis methods in this study.

Table 6. Instruments, type of data and analysis methods

Instrument	Type of data	Analysis method
Teacher needs analysis questionnaire	Quantitative	Descriptive statistics
Semi-structured interview guide for teachers	Qualitative	Thematic analysis
FDM checklist	Quantitative	FDM analysis
Pre-test and post-test assessment papers	Quantitative	Descriptive statistics, paired sample t-test
Teacher evaluation questionnaire	Quantitative	Descriptive statistics
Student evaluation questionnaire	Quantitative	Descriptive statistics

3. RESULTS AND DISCUSSION

Recognizing Chinese characters is a basic literacy skill that significantly impacts reading proficiency. However, non-native Chinese language learners face problems in reading skills due to their low proficiency in recognizing Chinese characters. Therefore, this study reports on the development of the CCM as a supplementary tool and material for non-native Chinese language learners in primary school, with the aim of improving their ability to recognize Chinese characters. The DDR approach that includes the three phases are the needs analysis phase, design and development phase, and evaluation phase will be conducted in this study. The first phase highlights the gaps in existing learning materials through document analysis, surveys, and structured interviews, enabling the researcher to confirm the need for CCM.

To ensure the module's validity, relevance, and practical applicability, the researcher designed the CCM in the second phase based on the findings from the first phase and refined it using 15 experts' feedback through the FDM to make sure the elements in the module align with the curriculum standards. The third phase is designed to evaluate the CCM through a quasi-experimental design. The pre-test and post-test results are expected to show that the CCM helps non-native learners recognize Chinese characters better than the usual teaching methods. It is also likely that the feedback from teachers and students will support the idea that the CCM is useful and works well in the classroom.

The findings also suggest that using pictures and simple game activities in the CCM suits learners aged seven to 12, which corresponds to Piaget's concrete operational stage in his cognitive development theory. At this stage, children think more logically but still depend on concrete and visual support to understand ideas. By using pictures and multimedia in CCM, students can build clear mental images of Chinese characters. This will make it easier to remember and recognize them because their curiosity and high imagination can encourage a more enjoyable learning experience, which was reflected in the results of this study.

A positive impact has been shown in findings from previous studies on interactive and innovative teaching modules that could enhance speaking-listening skills and reading-writing skills while increasing students' interest. These works highlight the importance of designing materials that match learners' needs. Yang *et al.* [45] examined English reading modules and their impacts on higher education students' learning outcomes, while Pei [46] found that the rhyme song module significantly improved reading and spelling skills among seven years-old pupils. Bashah *et al.* [47] showed the easy reading module enhanced engagement and reading development for preschool learners in the Malay language. In Tamil, Ganapathy *et al.* [48] reported that combining story writing with inquiry-based learning to enhanced language proficiency and cognitive development among Tamil primary school students. The study conducted by Noor *et al.* [49] conclude that AR-based instructional modules can improve Arabic language learning and recommend further exploring AR's potential in teaching Arabic as a second language.

This study's CCM shares similarities with these works by showing that innovative, interactive, and context-specific modules can make language learning more effective and enjoyable. At the same time, it is different in three important ways: i) it targets non-native learners of Mandarin in Malaysian SJKCs, a group that is often underrepresented in module design; ii) it focuses on the foundational skill of character recognition, an important skill to ensure students are able to read and understand long texts in the future; and iii) it is designed to be aligned with the national curriculum, ensuring direct applicability in real classrooms.

The development of a CCM in this study is very important for non-native learners in learning Chinese [50] because it is a supplementary material that aligns the existing Chinese curriculum for non-native learners. This is because Chinese language teaching materials for Year One, whether in recognizing Chinese characters, text arrangement, or activity design, all bring great challenges for non-native speaker students. Therefore, teachers can set aside some time each week to use the CCM during after school sessions. This module can support non-native learners in recognizing Chinese characters, helping to create a learning environment that is more inclusive and effective for everyone.

However, this study has several limitations. This study only focuses on design and development process of the CCM for non-native learners using pictorial and game-based approaches. So, effective testing does not include effectiveness at this stage. Thus, further and more in-depth studies are needed to confirm the module's impact, especially regarding on how well it improves character recognition and learning outcomes among non-native Chinese language learners. Besides that, sample size and context would be another limitation concerns. The study is limited to Year One pupils in Malaysian SJKCs, which means the findings may not fully apply to other age groups, levels, or learning environments.

This study demonstrates that pictorial and game-based strategies may be more effective for non-native learners than traditional text-based methods. The actual effectiveness of the CCM using feasible ways in classroom-based approaches may be explored in future studies, such as pre- and post-tests, teacher evaluations, and student feedback. Researchers may also consider extending the scope by developing a digital of the CCM to support enhanced technology learning. Besides that, researchers may also conduct longitudinal studies to track learners' retention of character recognition over time. Researchers also can apply the module in various educational settings to evaluate its adaptability and relevance across different learner groups.

4. CONCLUSION

This study offers a clear and organized way to develop the CCM to help non-native learners in SJKCs improve their ability to recognize Chinese characters. The study's main objectives are to identify the need for an effective educational module, design and develop it with the support of experts, and evaluate its effectiveness through real classroom testing. The CCM motivated non-native learners by making Chinese character learning more enjoyable. The structured use of instruments and data analysis at each phase ensures that the research objectives are clearly and effective.

The study also offers contributions in two important areas. From a theoretical point of view, it demonstrates how the DDR model can be applied in language education. The structured and systematic design of the CCM shows how DDR can guide the development of useful learning materials. From a practical perspective, the CCM provides teachers with a tool that fits within the national curriculum and supports inclusive teaching for non-native learners. By combining pictures and games, this CCM makes Chinese characters more easily to recognize and helps learners stay motivated.

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C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : **O**riginal Draft

E : **E**diting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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